Chriſtiani Hugenii Aſtroſcopia compendiaria, Tubi optici molimine liberata. Or the deſcription of an Aerial Teleſcope.

THe uſe of *Teleſcopes* being ſo neceſſary for *Aſtronomy* it hath been the endeavour of ſeveral lovers of that ſcience to find out ſome more convenient and eaſier way, for the handling of the ſame. Then whereas all the perfection that hitherto hath been added to Teleſcopes, chiefly conſiſteth, in making them very long and the glaſſes of a bigger ſphere, the ſame length and bigneſs thus increaſed, hath been ſtifled by a troubleſome heavineſs and diſproportion to manage and direct them to the Stars. The Author hence, to take off the incumbrance, hath found out a deviſe in cutting or leaving out almoſt the whole tube, ſaving only a ſmall part of it near the objective glaſs, and ſomewhat towards the Eye glaſs, ordering theſe two extremities in ſuch a manner, that they may do the ſame ſervice, as if the whole tube of one piece ſhould be imployed. To this purpoſe he explaineth himſelf by a ſcheme and clear deſcription, how a maſt muſt firſt be perpendicularly fixed into the ground, which for his own uſe he tells, was made of 50 foot long, ſerving for a Teleſcope of 70 foot, then joyning two parallel rules all along this maſt, he declareth how by this means the objective glaſs may be eaſily drawn up and downwards by the help of a ſtring or cord, applied to an equilibrated weight, ſo that it be correſpondent to the Eye glaſs. The circumſtances whereof can be read in his printed paper, where alſo the full ſtructure is to be ſeen. Only to come to the objection which the Author propoſes himſelf, againſt the uſe of this curtailed Teleſcope. The *Firſt*, is the ficklenes in keeping alwayes the Eyeglaſs in the ſame poſture: to remedy this, he deſcribeth a two legged inſtrument to be put under the 2 arms, to hold them up the more ſteadily. *Secondly*, it ſeemeth to be a hard matter, to find out at night time in ſuch a diſtance the objective glaſs or the Stars you look for, the cord alone not being able to direct the whole buſineſs: to help this inconveniency, he ſaith, one muſt make uſe of a lantern, which being in the ſame manner as commonly uſed for the projection of images, and diperſion of light, will give direction for the finding the objective glaſs, by inlightning the ſame for to

to make a due agreement with that other glaſs. But as to obſerve the Moon, there needs nothing of this, when the glaſs eaſily may be diſcovered by the Moon light it ſelf. *Thirdly*, it is very difficult to find (in ſuch a length of a Tube of 100 or 200 foot) the true paralleliſm of the two glaſſes, the ſtring being bended in the middle, and alſo not fit to give a true or ſtrait direction. To this he anſwereth 1. that there is no need of ſuch a geometrical perfection of paralleliſm, but that the ſame may have ſome latitude. 2. The ſtring being of a ſmall weight, and only a ſilk thred, which 50 foot long doth ſcarce amount to halfe a drachm, and yet able to hold 7 of weight, this bending of the ſtring will cauſe only a ſmall errour, for to find how much the bending maketh it decline, if it is ſuppoſed to be a parabolical line in the curvature, the angle of deflection by the tangent will come to 24 minuts which in 150 foot diſtance produceth an errour of one foot, that the Eye will be out of her true way of direction. But to remedy all this, he ſheweth how by the help of the Lanterne ſuch miſtakes may be corrected. *Fourthly*, the conſtitution of the air, as being windie, or tempeſtuous will make a great hindrance, for the ſtring or cord will be altered and drawn at one or the other ſide. To prevent this, there is no remedy: the common ſort of Teleſcopes being ſubject to the ſame troubles. Yea ſometimes, when the air is very quiet and the Sky clear, yet the ſtars much glittering, the Teleſcopes will not ſerve, alſo the vapours ſometimes will ſtick to the glaſs. *Fifthly*, againſt the lantern before mentioned, one might object that at a diſtance of 200 and more foot, the light projected would be very weak, and not well to be diſcerned: but to make it brighter, a greater lantern muſt be got and a bigger wick put in and other things ordered accordingly. *Sixthly*, if it ſhould be too troubleſome to, to fix ſuch a long maſt of a 100 and more foot, the Author ſheweth how the compoſition of maſts joyning one to another may be continued as far as neceſſity ſhall require. Yet for all that, he thinks, there will be no need to make theſe maſts of ſuch a vaſt height: for no body will bring the Teleſcopes to ſuch a perfection as to make appear any animal or creature in the Moon or Planets.

Becauſe, firſt, there is ſuch a difficulty in making the glaſſes, for the bigger they are, the more art is required in performing them. 2. There is ſcarce any piece of glaſs to be found fit for ſuch a large buſineſs, being peſtered with many faults. 3. The amplification of the things ſeen by Teleſcopes being regulated by the bigneſs of the aperture that the

the objective glaſs will be in ſomuch that the apertures are in a ſubduple reaſon to the lengths, it followeth that a Teleſcope of 30 foot requiring an aperture of 3 inches, to an other of 300 foot, that will bear no more then 9 inches and a half, is as 1 to 3. that is, will magnify but 3 times as much, but if it ſhould make 10 times as big, it would rquire a length of 3000 foot, which he thinketh not to be practicable. 4*th*. There are ſtill ſome irregularities in the nature of refractions, as is proved by Mr. *Newtons* experiments of colour, yet as far as is known, the ſaid reaſon of the apertures to the lengths is thereby confirmed. Finally, for the better uſe of this Teleſcope, he giveth an admonition, that to obſerve the Satellits of Saturn found out by *Caſſinus*, it is convenient to look through a narrow aperture, to exclude the light that cometh from the ſides, and to reſtrain the apple of the Eye, which in the dark uſe to be very large and open.

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